APPENDIX K

FIELD VERIFICATION REPORT
LOS ALAMOS NATIONAL LABORATORY
MAY 16 – 25, 1994

CONTENTS

ATTACHMENTS

EXECUTIVE SUMMARY

This report presents the results of a review of chemical safety vulnerabilities associated with facilities owned or operated by the Department of Energy (DOE) at Los Alamos National Laboratory (LANL). The field verification review took place on May 16–25, 1994, and was part of the Chemical Safety Vulnerability Review being conducted by the Office of Environment, Safety and Health at the direction of the Secretary of Energy. The purpose of the review is to identify and characterize conditions or circumstances involving potentially hazardous chemicals at DOE sites and facilities. Specifically, the review is designed to identify, characterize, and prioritize chemical safety vulnerabilities associated with conditions or circumstances that might result in (1) fires or explosions from uncontrolled chemical reactions, (2) exposure of workers or the public to chemicals, or (3) releases of chemicals to the environment.

Activities involving the use of hazardous chemicals at LANL include research and development laboratory processes; production-related processes and operations; cleanup of facilities being shut down; laboratory processes; long-term, large-scale storage; and the treatment and disposal of hazardous wastes. The lines of inquiry developed for the Chemical Safety Vulnerability Review were used as a guide for field verification activities at LANL. All facilities included in the LANL self-evaluations were reviewed, and additional facilities were reviewed when further information was needed.

The LANL field verification was conducted with a view toward identifying possible DOE-wide chemical safety vulnerabilities. Three chemical safety vulnerabilities were identified at LANL, none of which represents a potential consequence of high severity in the near term:

- Significant accumulations of hazardous chemicals and wastes are being stored for prolonged periods, some under unsatisfactory conditions;

- The lack of funding could affect the safe cleanup or transition of aging and/or inactive facilities; and

- The absence of a consistent approach to chemical safety at LANL can result in unanticipated chemical risks.

These vulnerabilities, along with those identified at other DOE sites, will be evaluated to identify DOE-wide generic vulnerabilities. Information from the Office of Environmental Management's Surplus Facilities Inventory Assessment and the extended review of potential organic-nitrate vulnerabilities (similar to those at Tomsk-7) will also be considered. The results of these activities will be reviewed for additional insights into potential chemical safety vulnerabilities confronting the Department.

The field verification team also identified the following commendable practices pertaining to chemical safety at LANL:

- The use of an innovative labeling system that incorporates DOE, Clean Air Act, Department of Transportation, Environmental Protection Agency, LANL, Resource

Conservation and Recovery Act, and American National Standards Institute labeling requirements into a single label;

- The development and use of the new Hazardous Materials Training Facility for training and conducting practical hands-on, hazardous-materials drills for both onsite and offsite emergency response organizations; and

- The modification of Meteorological Information and Dose Assessment System software, which calculates and displays dispersion data for hazardous materials plumes, to incorporate site-specific meteorological factors.

Based on this review in general and these practices in particular, the field verification team concludes that LANL personnel have a strong commitment to chemical safety. Although a consistent overall approach for implementing a sound chemical safety program is lacking, many of the essential elements of such a program are in place and improvements are planned.

1.0 INTRODUCTION

1.1 Purpose and Scope

Based on direction from the Secretary of Energy, the Assistant Secretary for Environment, Safety and Health established the Chemical Safety Vulnerability Working Group to review and identify chemical safety vulnerabilities at facilities operated by the Department of Energy (DOE). The information obtained from the review will provide the Working Group with valuable input for identifying generic chemical safety vulnerabilities that confront the DOE complex. Prioritizing the generic chemical safety vulnerabilities that are identified will establish the proper basis for departmental focus on programs, funding, and policy decisions related to chemical safety. The Secretary directed the Office of Environment, Safety and Health (EH) to lead this review, with full participation from DOE line organizations having operational responsibilities.

The Chemical Safety Vulnerability Review was designed and undertaken to identify and characterize adverse conditions and circumstances involving potentially hazardous chemicals at facilities owned or operated by the Department. Specifically, the review is intended to identify, characterize, and prioritize chemical safety vulnerabilities associated with conditions or circumstances that might result in (1) fires or explosions from uncontrolled chemical reactions, (2) exposure of workers or the public to hazardous chemicals, or (3) release of hazardous chemicals to the environment. Using input provided by line organizations with operational responsibilities, the Working Group developed the "Project Plan for the Chemical Safety Vulnerability Review," dated March 14, 1994, to guide the review.

The field self-evaluation phase of the review used a standardized question set developed and distributed by the Working Group to collect data related to chemical safety from 84 facilities located at 29 sites. Based on analysis of self-evaluation data, nine large sites, including Los Alamos National Laboratory (LANL), and four small sites were selected to participate in the field verification phase of the review. The field verification process was designed to use independent teams of technical professionals with experience in a variety of technical disciplines to confirm the accuracy and completeness of the data compiled during the field self-evaluation phase of the review. This report documents activities related to the field verification phase of the Chemical Safety Vulnerability Review.

The field verification team visiting LANL examined a broad range of facilities (based on facility type and operational status), with special attention given to those facilities being transitioned to, awaiting, or undergoing decontamination and decommissioning (D&D). Different types of chemical- and waste-handling facilities were examined to permit identification of vulnerabilities arising from hazardous chemicals and wastes at the site. (See Section 1.3 for a listing of the key facilities visited.)

The field verification team, under the direction of a DOE team leader, was composed of DOE and contractor personnel with technical expertise in various aspects of chemical safety, including management and operations, training, chemical process safety, industrial hygiene, maintenance, environmental protection, and emergency management. The team included one working group member and two site liaisons. A team composition list is provided in Attachment 1 of this appendix.

The team began its review by visiting each of the facilities selected for self-evaluation. Team members met with management or technical representatives from each of the facilities reviewed. Individual and small group meetings were also held, and team members conducted walkthroughs, document reviews and personnel interviews to gather information related to potential chemical safety vulnerabilities at LANL. The team leader met periodically with management personnel to discuss the team's activities and issues that may have surfaced during the previous day. Before the field verification team left LANL, management from local DOE and contractor organizations conducted a factual accuracy review of the draft report. An outbriefing was conducted on Wednesday, May 25, 1994, and a draft copy of this report was left with DOE and contractor management.

1.2 Site Description

Located in north-central New Mexico, the Los Alamos National Laboratory comprises about 43 square miles of DOE-owned land in Los Alamos, Sandoval, and Santa Fe Counties. LANL is about 90 miles driving distance north of Albuquerque and 35 miles driving distance northwest of Santa Fe. The site and the adjacent communities of Los Alamos and White Rock are situated on the Pajarito Plateau, a volcanic shelf on the eastern slope of the Jemez Mountains, at an elevation of about 7,000 feet. LANL currently comprises about 50 designated technical areas (TAs) that reflect a variety of functions, including building sites, experimental areas, waste disposal locations, roads, and rights-of-way for utilities. (See Figure 1.)

Most LANL installations are situated on mesa tops, although a few important facilities are located in canyons. Historically, the isolation of the region and its low population density have contributed to public safety and the security of LANL's facilities, although public access is permitted to certain parts of the site. In general, LANL is surrounded by undeveloped land, with large tracts to the north, west, and south belonging to the Santa Fe National Forest, the Bureau of Land Management, Bandelier National Monument, the General Services Administration, and Los Alamos County. The San Ildefonso Indian Reservation borders the site to the east.

The LANL site includes facilities constructed during World War II as well as recently built modern structures. LANL's original mission was to design, develop, and test new defense and security technologies. Today, however, LANL's activities focus on the development of innovative technologies involving energy, nuclear safeguards, biomedical science, environmental protection and cleanup, computational science, materials science, and other types of basic scientific research and development.

The organization of work at Los Alamos provides a number of mechanisms through which information about chemical safety practices and requirements can be communicated. The two groups with principal responsibility in this area are the University of California, which is the management and operating contractor for LANL, and Johnson Controls World Services, Inc. (JCI), which is the main support services contractor. JCI operations include

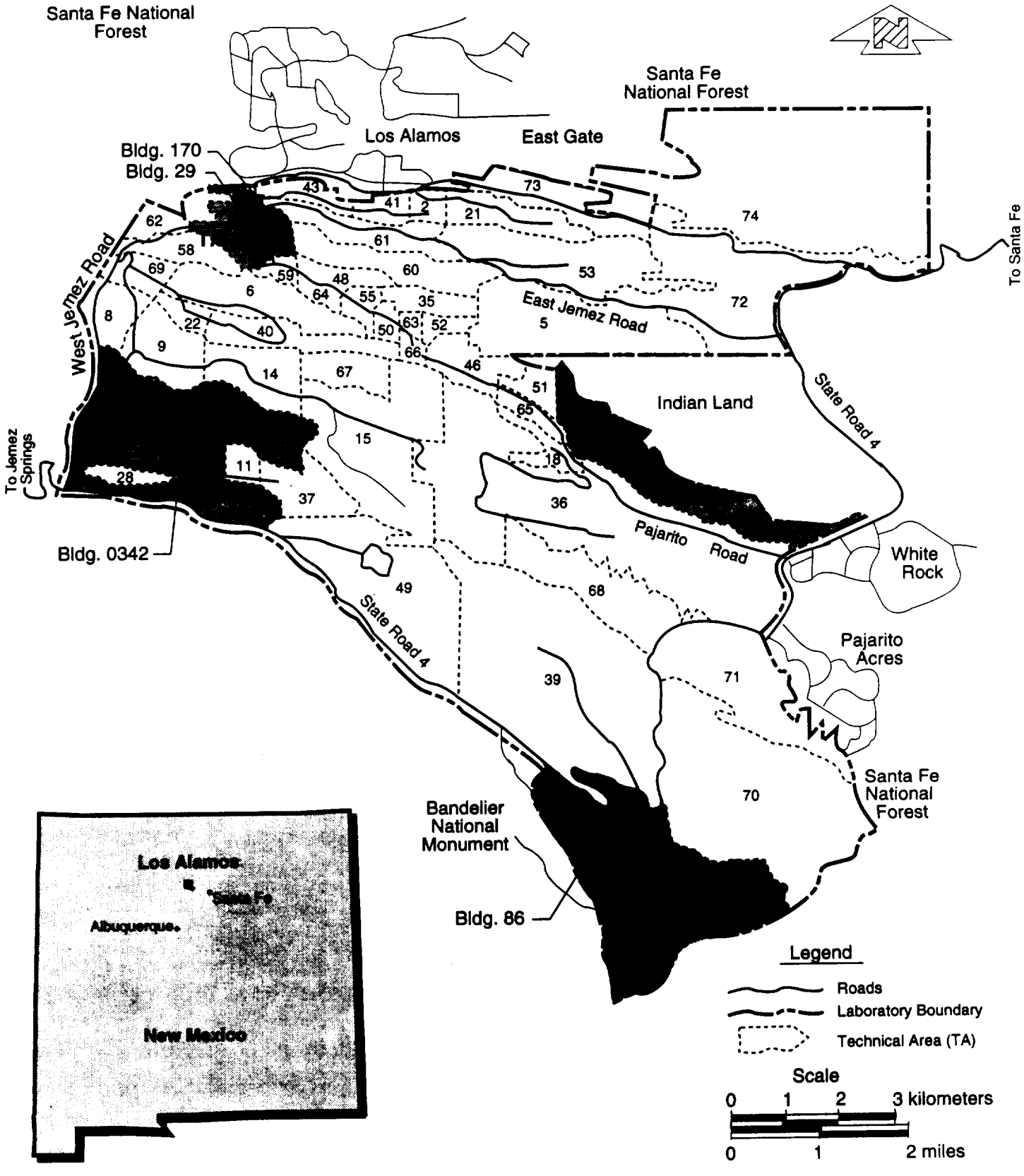

Figure 1. Los Alamos National Laboratory Site

the water treatment systems, which use large quantities of chlorine. Smaller organizations, such as VWR Scientific, Inc., which supplies chemicals to site facilities, and the LANL Fire Department also provide crucial services that can affect chemical safety.

1.3 Facilities Visited

Table 1 identifies key facilities visited by members of the field verification team at the Los Alamos National Laboratory and includes information related to the physical condition and mission of each facility. In addition, the field verification team observed activities at the Laboratory's primary dedicated Emergency Operations Center (EOC), the dedicated alternate EOC, and the Hazardous Materials Training Facility.

Table 1. Key LANL Facilities Visited

FACILITY	MISSION	DESCRIPTION
Chemistry and Metallurgy Research Facility (TA-3, Bldg. 29)*	Nonreactor nuclear laboratory facility	Constructed in 1952, this 550,000-square-foot building is classified as a nonreactor nuclear laboratory facility. The building includes seven three-story laboratory wings and an administrative wing. Most laboratories are located on the second level and are used for analytical chemistry, materials research, and processing science. Chemicals, hazardous wastes, and mixed wastes are located in designated storage areas in each wing.
General Warehouse Building (TA-3, Bldg. SM-30)	Materials receiving, storage, distribution, and shipping	This 60,000-square-foot warehouse, office, and technical support building is constructed of poured concrete. It is divided by a permanent firewall running north and south through the building. It contains a high-bay roof supported by concrete pillars. Building operations include the receipt of chemical radioisotopes in small quantities.
Chemical Warehouse Building (TA-3, Bldg. SM-31)	Receipt, storage, and distribution of hazardous chemicals	This 30,000-square-foot warehouse and office building is constructed of poured concrete. It is divided by a permanent firewall running north and south. It contains a high-bay roof supported by concrete pillars with loading docks on the north, east, and west sides of the building. Hazardous chemicals in the building are managed by VWR Scientific, Inc., and the LANL Business Operations Division (BUS) receives, stores, and issues furniture, metal drums, and anticontamination clothing.
Compressed and Liquified Gas Facility (TA-3, Bldg. 170)*	Warehousing and distribution services for numerous inert, flammable, toxic, and oxidizing gases and for bulk storage of gas products	This facility includes several structures. The main building, SM-170, is an 8,900-square-foot structure used to store inert gas products. SM-1650 (constructed in 1988) is a metal storage building for flammable gas cylinders. SM-476 is an all-metal prefabricated storage building for toxic gas cylinders. SM-1942 is an all-metal transport container used for general storage. Tube trailers associated with the facility are used for bulk storage, hold an average of 59,000 cubic feet of product, and are transported to users across the LANL site.

Table 1. Key LANL Facilities Visited (Continued)

FACILITY	MISSION	DESCRIPTION
Explosives Development Processing Facility (TA-16, Bldg. 340)*	High-explosive processing, raw material and hazardous waste storage	This 25,000-square-foot facility has nine operating bays and is used for the formulation of high explosives. No raw material is stored in the facility. Each operating bay contains a satellite waste storage area, and Room 114 contains a 90-day storage area.
High Pressure Tritium Laboratory (TA-33, Bldg. 86)*	Nonreactor nuclear laboratory facility	This facility consists of a one-story, steel-reinforced concrete building with dimensions of about 36 × 16 × 6 meters. A small penthouse on the main roof at the north of the building shelters the ventilation and exhaust system for the process room. The air in the process room is exhausted through a 23-meter stack at the north end of the building. Before it was shut down, the facility was used for experimental activities involving gaseous tritium and other hydrogen isotopes.
Wastewater Treatment Facilities (TA-46)	Treatment of sanitary wastewater from LANL facilities	This plant consists of several structures located on about 10 acres. It began operation in 1992. The plant includes a 2,640-square-foot building that houses offices, control room, laboratory, and maintenance shop. Wastewater is treated using an extended aeration, nitrification-denitrification process. Plant components include equalization basins, aeration basins, clarifiers, chlorination facilities, sludge-drying beds, and treated effluent-return system. The chlorine supply building contains four 1-ton chlorine cylinders under a protective shed.
Waste Storage Facilities (TA-54)*	Waste storage and treatment	These facilities occupy 2.58 acres on Mesita del Buey, a finger mesa that is bounded by Canada del Buey Canyon on the north and by Pajarito Canyon on the south. The complex lies on about 700 feet of Bandalier Tuff at an 6,400–6,700-foot elevation. Solid mixed wastes are managed at Area G, and chemical and mixed wastes are managed at Area L.
Well-Water Chlorination Station, Pajarito Booster No. 2, (TA-54, Bldg. 1008)	Chlorination of well water	This 180-square-foot concrete-block building houses a chlorination station for several wells. The building typically contains two 150-pound chlorine cylinders on line and five in storage.

Facilities marked with an asterisk (*) were included in the field self-evaluation process.

2.0 SUMMARY OF RESULTS

The field verification process was designed to use independent teams of safety professionals to verify the accuracy and completeness of data provided to the Chemical Safety Vulnerability Working Group by LANL facilities selected to participate in the field self-evaluation process. The verification process offers an opportunity to scrutinize site-specific chemical safety vulnerabilities and to make informed judgments about the possible relevance of these conditions to determinations of generic chemical safety vulnerabilities.

During the onsite portion of the review, team members visited facilities selected for self-evaluation and conducted interviews with site personnel to verify reported observations and to look for other conditions or circumstances that might result in chemical safety vulnerabilities. Water treatment facilities using chlorine that were not included in the original self-evaluation were also reviewed. Team members who visited these facilities coordinated with their site counterparts to arrange for the appropriate walkthroughs or interviews.

To support effective team management and to expedite the identification of vulnerabilities across a wide range of technical disciplines associated with chemical safety, the field verification review was organized to include five functional areas:

- Identification of chemical holdings, including the properties of chemicals located at the facility, the characterization of those chemicals, and an analysis of the inventory.

- Facility physical condition, including engineered barriers, maintenance conditions, chemical systems, safety systems, storage, monitoring systems, and hazards identification.

- Operational control and management systems, including organizational structure; requirements identification; hazard analysis; procedural adherence; maintenance control; engineering and design reviews; configuration control; safe shutdown plans; and site programs for quality assurance, chemical safety, inventory control, access control, disposal, transportation and packaging, and corrective actions.

- Human resource programs, including technical competence, staffing, training and qualifications, employee involvement, employee concerns, personnel performance requirements, and visitor and subcontractor access control.

- Emergency management program, including the emergency response plan, in-plant consequences, environmental issues, coordination with the community, and community right-to-know issues.

These functional areas were evaluated based on lines of inquiry provided in Attachment 1 of the "Field Verification Guide for the Chemical Safety Vulnerability Review," dated April 8, 1994. A summary of results for each of the functional areas is provided below. Completed chemical safety vulnerability forms resulting from the field verification activities at LANL are provided in Attachment 2 of this appendix.

2.1 Identification of Chemical Holdings

Verification activities associated with the chemical holdings functional area included a review of chemical, hazardous, and mixed waste inventories and an evaluation of storage practices, chemical processes, and associated physical and administrative controls for facilities identified in the LANL chemical vulnerability self-evaluation. The review focused on those activities having a potential for presenting a significant risk to personnel, facilities, the public, or the environment. Chemicals and wastes observed at LANL included laboratory chemicals, acids, caustics, compressed gases, and radioactive and mixed wastes. Particular emphasis was placed on evaluating controls for highly toxic materials (including carcinogens) and acute toxins (including phosgene and arsine).

Chemical inventories at LANL are managed by the Automated Chemical Inventory System (ACIS), which was developed to upgrade chemical management capabilities at the Laboratory. ACIS is being actively used in LANL facilities for a number of purposes, including screening for chemicals that exceed threshold quantities established by the Occupational Safety and Health Administration (OSHA) and the Environmental Protection Agency (EPA) and to satisfy the reporting requirements of Title III of the Superfund Amendments and Reauthorization Act (SARA) for State, local, and Laboratory emergency planning organizations. LANL requires annual updates to the ACIS inventory, but the Materials Research and Processing Science Group (MST-5) at the Chemistry and Metallurgy Research Facility (CMR) (TA-3, Bldg. 29), on its own initiative, is using ACIS as a tool to control chemical inventory. The chemical safety coordinator for this group regularly updates ACIS whenever information related to changes in chemical inventory is provided.

Some features of ACIS are not currently being used (e.g., providing chemical inventory information on a near real-time basis and monitoring shelf life of chemicals). These features have not been implemented because of lack of resources within the Industrial Hygiene and Safety Group (ESH-5) and because the system has not been fully accepted by some Laboratory organizations. Weaknesses in ACIS as it is currently implemented were also observed. For example, the system does not require an industrial hygiene review of chemical purchases, LANL buyers do not always specify appropriate locations for delivery of purchased chemicals to facilitate bar-coding and entry into ACIS, and chemicals are not tracked to their ultimate waste form. In addition, chemical storeroom inventories managed by VWR Scientific, Inc., are not entered into ACIS until they are withdrawn from stores by a LANL requisitioner. Thus, ACIS does not accurately reflect the Laboratory's total chemical inventory at any given time.

Chemical and waste storage at LANL is performed in accordance with permits, requirements, and agreements between LANL, the State of New Mexico, and EPA. Generally, strict adherence to these requirements is observed and wastes are properly characterized, labeled, segregated, and supervised. Flammable chemicals at LANL are properly segregated and stored in accordance with the provisions of applicable administrative requirements (ARs). Storage of chemicals in laboratories is controlled by the LANL Chemical Hygiene Plan, which has been effective in controlling chemical storage of laboratory chemicals. However, storage criteria regarding other chemical-related issues (e.g., incompatibilities, secondary containment, flammable vapor monitoring, or the concurrent storage of chemicals with radioactive or fissile materials) either do not exist or are unclear.

Several hundred gallons of acids and caustics were observed in a small storage area in the CMR with several drums containing radioactive and fissile materials. Secondary containment was not in place to prevent the commingling of incompatible chemicals or damage to radioactive and fissile materials drums in the event of an unplanned chemical release. If an unplanned chemical release should occur, potential consequences include personnel exposures, violent chemical reactions, fire, radioactive materials releases, unnecessary hazardous or mixed waste generation, or exposure to the public or the environment. (See Vulnerability CSVR-LANL-OMS-03.)

Documented hazards analyses were available for all facilities reviewed in the self-evaluation, as well as for the Wastewater Treatment Facilities (TA-46). Draft safety analysis reports (SARs) were prepared for the High Pressure Tritium Laboratory (HPTL) (TA-33, Bldg. 86), the Explosives Development Processing Facility (TA-16, Bldg. 340), and CMR. A safety assessment was prepared for the Compressed and Liquified Gas Facility (TA-3, Bldg. 170), and preliminary hazards analyses (PHAs) were prepared for the Waste Storage Facilities (TA-54) and the Wastewater Treatment Facilities. The analyses varied in the extent to which chemical hazards were analyzed. The draft SAR for the CMR building includes a comprehensive analysis of chemical risks; in contrast, the draft SAR for the HPTL primarily considers radiological risks.

Because of a recent chlorine accident at the Idaho National Engineering Laboratory the field verification team was asked to expand the scope of its review to include operations at LANL facilities in which chlorine was used or stored. The main users of chlorine at LANL are the Wastewater Treatment Facilities and eight well-water chlorination stations located across the Laboratory. The wastewater plant is the only LANL facility of any type that routinely exceeds OSHA threshold quantities for hazardous chemicals cited in 29 CFR 1910.119 or 40 CFR 68. The wastewater plant uses 1-ton cylinders of chlorine and normally has an inventory of 8,000 pounds of chlorine, whereas the well-water stations use smaller 150-pound cylinders. The Pajarito Booster No. 2 well-water station normally has an inventory of 1,050 pounds of chlorine, and the Compressed and Liquified Gas Facility has an inventory of 1,200 pounds. Other facilities at LANL use smaller amounts of chlorine in lecture-bottle containers.

The chlorination systems examined by the verification team were modern and well maintained. Designs used for chlorine feed and cylinder storage and procedures for chlorine alarm response, chlorine station entry, and cylinder changeout were found to be satisfactory and minimized hazards arising from potential chlorine leaks. However, the Wastewater Treatment Facilities are not equipped with a direction indicator (e.g., windsock) to ensure that personnel are able to evacuate the site upwind of a potential airborne release. A single crew of trained operators changes out all chlorine cylinders on the site. Changeout procedures require that an operator entering the chlorine room carry a full-face respirator equipped with a chlorine cartridge. A standby operator with a self-contained breathing apparatus (SCBA) must be present. At LANL, operators carry the respirators but do not wear them routinely. A chlorine monitor is installed in each chlorination facility.

A release from the wastewater plant could affect occupants of nearby buildings or the public. About 600 people are housed in LANL buildings located within 1 kilometer of the Wastewater Treatment Facilities. Although there were no indicators that the risk of chlorine release at LANL is higher than that for well-designed and well-maintained municipal facilities, use of

alternatives to gaseous chlorination (e.g., sodium hypochlorite solution or ultraviolet treatment) would decrease risks. A process safety management program has been prepared and is currently being implemented at the Wastewater Treatment Facilities.

Liquid and solid wastes at LANL are characterized at the point of generation through process knowledge and/or sampling and analysis before disposition. At the waste management facility in TA-54, 1 percent of all incoming waste containers are sampled as a quality assurance measure. An innovative labeling system used at LANL incorporates DOE, Clean Air Act (CAA), Department of Transportation, EPA, LANL, Resource Conservation and Recovery Act (RCRA), and American National Standards Institute labeling requirements into a single label that is more efficient and reduces opportunities for error.

Solid mixed waste is managed at TA-54, Area G, in an enclosed structure. Chemical and liquid mixed wastes are managed at TA-54, Area L, where a waste pit, 3 surface impoundments, and 34 shafts were originally located. Area L has since been capped and paved. The area is controlled physically and administratively and will eventually be remediated under the Hazardous and Solid Waste Amendments to RCRA. Active storage units for mixed waste have been located on the open paved area where they are exposed to the elements. Two thousand drums of mixed and nonregulated radioactive waste are being stored at this location. Construction of a storage building is expected to begin in June 1994. About 500 cylinders of waste flammable and toxic gases are stored in Area L. By the end of 1994, all but about 100 cylinders will have been transferred to offsite treatment facilities. The ultimate disposal plan for the solid mixed waste, liquid mixed waste, and waste compressed gas cylinders is being developed under the Federal Facility Compliance Agreement. The facility is being operated in accordance with its RCRA permit. (See Vulnerability CSVR-LANL-CH-01.)

At CMR, the team noted delays in the disposition of hazardous wastes from a satellite accumulation area where waste is being held from a laboratory that has been abandoned for more than 2 years. These delays were attributed to a lack of sufficient sampling and analytical support.

The LANL Environment, Safety and Health (ESH) Division is responsible for administering the Spill Prevention Control and Countermeasure Plan, which provides for spill prevention, secondary containment, quick spill response, and cleanup of oils and chemicals. Defined engineering and administrative controls reduce risk to workers and the public. Records indicate that few chemical spills are reported at LANL and that most of these can be traced to container handling and equipment leaks.

The Water Quality and Hydrology Section of the Environmental Protection Group (ESH-8) has responsibility for the identification and characterization of hazardous constituents in wastewater discharges. All outfalls have been identified and characterized. Sixty-two outfalls are in the process of being permitted in accordance with EPA National Pollutant Discharge Elimination System requirements. Engineering and administrative controls are in place to prevent unplanned releases of regulated materials into the environment.

The Air Quality and Meteorology Section of the Environmental Protection Group (ESH-8) is responsible for quantifying nonradioactive air emissions at LANL. Air emissions sources have

been divided into three categories: (1) power plants, (2) potable and wastewater treatment facilities, and (3) remaining laboratory facilities. Emissions from the power plant and water treatment facilities are based on measurements and process knowledge. Other facility emissions are generally quantified using the assumption that the quantity of chemicals purchased is the quantity released. LANL's approach is conservative and meets the requirements of the CAA and the State of New Mexico operating permit program.

Verification activities related to the identification of chemical holdings indicated that chemicals and wastes at LANL are being managed responsibly and appropriately. The two vulnerabilities related to this functional area emphasize the need for continued efforts in addressing chemical safety issues at LANL. (See Vulnerabilities CSVR-LANL-CH-01 and CSVR-LANL-OMS-03.)

2.2 Facility Physical Condition

Verification activities associated with the facility physical condition functional area included review of general maintenance conditions at all facilities selected to participate in the field self-evaluation. The review focused on conduct of maintenance activities, maintenance program controls, work controls, and structural and mechanical integrity for various systems and structures (e.g., heating, ventilation, and air conditioning).

Facility physical conditions observed by the field verification team varied among the facilities visited. For example, the Compressed and Liquified Gas Facility (TA-3, Bldg. 170) was in excellent condition, but portions of the Explosives Development Processing Facility (TA-16, Bldg. 340) were in fair to poor condition. Maintenance activities are generally accomplished in a safe manner. When appropriate safety measures are included, work control documents are generally adequate to control maintenance activities. Improvements in this aspect of work control are needed.

The Chemistry and Metallurgy Research Laboratory (TA-3, Bldg. 29) is currently in a transition phase. Equipment in many laboratories has been removed, and plans are in place to convert the facility to other missions. Several modifications are now under way, including the replacement of electrical system switchgear. To refurbish or upgrade the facility in a manner that meets current standards requires replacement or repair of old or obsolete equipment (e.g., exhaust fans and filter equipment). This situation represents a chemical safety challenge because much of the equipment may be contaminated with residual hazardous and/or radioactive material. Characterization of these systems and equipment to determine the extent of this contamination is not yet complete. However, a conceptual design review has been undertaken to address these issues.

Maintenance at the Explosives Development Processing Facility needs more attention. The LANL self-evaluation noted instances of residual explosive material in this facility. At the time of this review, general system and facility conditions were only fair to poor; specifically, the roof showed evidence of cracks and leaks, pressure and temperature instrumentation for process systems was not well maintained, and deactivated equipment had not been removed from individual explosive process bays. Process equipment in the facility is in acceptable condition, but some has not been operated for several years. These problems can be traced to lack of program funding for maintenance activities and lack of workload for the facility.

Surveys of user groups have been conducted to determine what equipment should receive continued maintenance and what should be put into standby, thereby facilitating more efficient use of limited resources. To complicate this situation, plans are under way to use two of the facility's nine bays for work activities being transferred from another DOE facility. However, the funding to implement upgrades needed to support this change in workload has not yet been approved by DOE.

Conditions at the High Pressure Tritium Laboratory (HPTL) (TA-33, Bldg. 86) have improved consistently since 1992, although problems still exist. For example, work areas were cleaned up and contaminated items were removed to approved waste storage areas. Attempts have been made to process and remove accountable tritium via installed systems, but the poor reliability of the process equipment limited the success of this effort. Accountable amounts of tritium remain in process systems. Accessible portions of the facility are generally in good condition, and maintenance is conducted in a manner ensuring that most of the facility (e.g., heating and ventilation systems) will continue to function properly. The tritium process systems could not easily be maintained because of high levels of contamination and the age of the equipment. Funding for maintenance and operations activities and for characterization and removal of residuals in fiscal year (FY) 95 has not yet been identified. The only potential source of funding appears to be reprogrammed Laboratory funds provided by the Headquarters Office of Defense Programs. (See Vulnerability CSVR-LANL-OMS-02 for a discussion of how lack of funding for aging facilities has contributed to a potential chemical safety vulnerability.)

The Waste Storage Facilities at TA-54 and the Compressed and Liquified Gas Facility were observed to be in very good physical condition. Maintenance activities at the gas plant are especially effective, and the facility is maintained in a manner that would minimize problems involving chemical safety. A recently completed modification of the lightning arrestor system was noted as a positive maintenance upgrade that improved the safety of flammable gas storage areas. The waste storage area at TA-54 does not represent a significant maintenance problem. Because the facility's inventory of operating equipment is small, maintenance requirements are few.

Corrective and preventive maintenance conducted at LANL are primarily accomplished by the support contractor (i.e., JCI) or by dedicated technicians at individual facilities. Safety and health and maintenance engineering personnel interact successfully with the maintenance work force. Work control documentation requires input from the Environment, Safety and Health (ESH) Division staff before most work activities begin. The only exception to this involves equipment related to specific programs—for example, the Explosives Development Processing Facility, where onsite specialists accomplish the required safety reviews. JCI has only a limited safety and health staff, which must interact with laboratory personnel for ensuring safe work practices. The ESH Division has implemented other controls to ensure that proper safety measures are incorporated into work activities. For major tasks, an environment, safety, and health (ES&H) questionnaire is provided to the initiating group to identify appropriate information and/or concerns related to the proposed work activities. When used, information from the questionnaire is translated into safety requirements in subsequent work process documents. Enhancements in the use of this questionnaire are being planned.

Maintenance activities at LANL are generally conducted in a manner that reduces the potential for chemical hazards; however, the age of some facilities and the lack of sufficient funding for maintenance activities could contribute to chemical safety vulnerabilities in the future. (See Vulnerability CSVR-LANL-FM-02.)

2.3 Operational Control and Management Systems

Verification activities for the operational control and management systems functional area at LANL followed the lines of inquiry established by the Chemical Safety Vulnerability Working Group. Each of the self-evaluation reports compiled by LANL referenced management programs, procedures, and/or reports that were used to conduct preliminary interviews and to establish areas of emphasis related to the transition and cleanup of aging facilities containing chemical residues.

A recent Laboratory-wide reorganization has resulted in broader spans of control and has eliminated a layer of management. At the same time, a Laboratory Leadership Council has been formed, consisting of the Laboratory Director and Deputy Director, Division Directors, Program Directors, Office Directors, and the Laboratory Counsel. These changes are intended to force decision making down through the organization and to promote horizontal integration of the various divisions, offices, and program directorates. In addition, a facility manager concept is being implemented to promote line management ownership of ES&H matters and to provide for the overall management and operation of major Laboratory facilities or groups of facilities. These changes have created a measure of uncertainty about ES&H roles and responsibilities throughout the Laboratory, but they have not compromised chemical safety at LANL.

Chemical safety at LANL is implemented through multiple programs. No Laboratory-wide policy for chemical safety exists; however, various administrative requirements (ARs) are in place to implement programs that support chemical safety. No single document describes an overall chemical safety program or how various programmatic elements are integrated. In addition, the implementation of programs supporting chemical safety has been fragmented. The verification team concluded that LANL has many of the essential elements in place for a good chemical safety program, but a consistent overall approach for implementing such a program is lacking. (See Vulnerability CSVR-LANL-OMS-03.)

Information on hazards is effectively communicated to employees. Health hazard information is available and accessible to Laboratory employees through the use of material safety data sheets (MSDSs) and through contact with representatives from the Industrial Hygiene organization. Implementation of requirements for the application of labels and hazard warnings to chemical and waste containers and process lines has been one of LANL's successes—chemicals and waste materials have been effectively labeled.

The effectiveness of procedures and administrative controls varies greatly within the Laboratory. At some facilities (e.g., Explosives Development Processing Facility; TA-16, Bldg. 340), formal procedures govern operations and personnel adhere strictly to these requirements. In laboratory areas (e.g., the Chemistry and Metallurgy Research Facility, or CMR; TA-3, Bldg. 29), procedures and controls are often viewed as guidelines. Employees, scientists, and supervisors occasionally make individual judgments about how Laboratory

policies and guidelines should be applied. Adherence to policies, procedures, and controls is not uniform across the Laboratory, and prescriptive sitewide guidance related to this issue does not exist.

Although ARs specify storage criteria for wastes, flammable liquids, and laboratory-scale chemicals, LANL has not established criteria addressing chemical incompatibilities, flammable vapor monitoring, or the concurrent storage of chemicals with radioactive or fissile materials. At present, chemical storage criteria are established informally on the basis of discussions between facility and ES&H personnel.

Medical surveillance programs, including those for asbestos, beryllium, lead, carcinogens, highly toxic chemicals, and hazardous wastes, have been established to manage health risks for LANL employees. Workplace monitoring is performed to support these functions, and minimal monitoring is conducted to address personnel exposures for personnel not enrolled in designated medical surveillance programs. For example, baseline monitoring has not been performed for personnel working in the Explosives Development Processing Facility because these workers are not considered to be "high risk." Although hazard inventories exist for some waste and chemical process facilities, LANL has not implemented a sitewide hazards inventory program. The Industrial Hygiene and Safety Group (ESH-5) has requested Laboratory funding for a health hazards assessment program that would identify chemical, physical, and biological hazards in the workplace and that would result in a risk-based approach for mitigating those hazards. The funding request for this program has been submitted twice over the past 2 years but has not been approved.

LANL provides safety equipment and necessary personal protective equipment for employees performing work with chemicals and wastes. However, some emergency eyewash units have not been selected or installed appropriately. Drench hoses are often installed where eyewashes are necessary; nonpotable water may be used instead of potable water; and eyewash and shower stations may not be readily accessible. Inappropriate or inaccessible emergency wash stations could contribute to personal injury in the event of an accident involving hazardous chemicals or wastes.

An ES&H questionnaire (described in AR 1-10, "Environment, Safety, and Health Questionnaire," dated August 30, 1991) is used to review proposed research projects, process changes, and facility modifications. As a result of this process, chemical, carcinogenic, and biological hazards are identified and mitigating actions are developed. Although this system provides a framework for identifying hazards, it has not been implemented consistently or in a timely manner.

The lessons-learned program at LANL is managed by the Appraisal and Performance Analysis Group (AA-1) of the Audits and Assessments Office. The current program has been in existence since early 1992. This group publishes information bulletins, good work practice bulletins, lessons-learned newsletters, and lessons-learned caution bulletins. This information is distributed to LANL managers (group leaders and above) and to other interested parties. In addition, facility managers and trainers collect lessons-learned information from a variety of other sources (e.g., the operating experience weekly summary originating within the Occurrence Investigation Group, ESH-7). At the facilities visited during this review, however, interviews indicated that lessons learned do not always reach facility managers, trainers, or

workers. For example, when asked about a recent chlorine uptake incident at the Idaho National Engineering Laboratory, no one knew about the accident. In fact, the facility manager of the Compressed and Liquified Gas Facility (TA-3, Bldg. 170) indicated that he learned about the incident during the inbriefing for this review. The LANL lessons-learned program is expected to benefit from recommendations of the newly established DOE Lessons Learned Working Group, which includes representation by AA-1.

A new configuration management system is currently being implemented at CMR. Authorization basis documents will serve as the baseline for change control. As part of that plan, the facility manager at CMR is attempting to document process histories and to update building configuration drawings wherever possible. At present, changes to chemical processes and related equipment are reviewed only insofar as they affect the baseline authorization basis documents. However, any new activities involving Category I chemicals are reviewed by ESH-5.

Although a formal configuration management plan does not exist at the Explosives Development Processing Facility, changes to chemical processes and equipment are carefully controlled through the use of special work permits (SWPs) and high-explosive documents (HEDs). Both SWPs, used for temporary or experimental changes, and HEDs, used for major changes to chemical processes and systems, require a minimum of two levels of line management approval, as well as review and approval by the Environment, Safety and Health Division.

Loss of corporate knowledge related to process and facility history at both the CMR and the High Pressure Tritium Laboratory (HPTL) (TA-33, Bldg. 86) is an issue impeding the progress of cleanup activities. For example, wastes have been stored in Wing 4 of the CMR for 2 years. The contents of these containers must be analyzed because the generator of these wastes is no longer at LANL. Similarly, knowledge about processes and building systems at HPTL resides essentially with one person who is currently a Laboratory Associate. HPTL management expressed concern that this individual may not be available for the protracted timeframe required for the characterization and removal of tritium and other chemical residues.

Based on interviews conducted at the Waste Storage Facilities (TA-54, Area L) and the Compressed and Liquified Gas Facility and on a spot check of training records, the verification team concluded that drivers transporting hazardous materials meet all established requirements and that their certifications are current.

Overall, LANL has many of the essential elements in place for a good chemical safety program. However, program effectiveness has been hampered by lack of a consistent approach to program implementation.

2.4 Human Resource Programs

Verification activities associated with the human resource programs functional area at LANL focused on technical competence, staffing, training and qualifications, employee involvement, employee concerns, personnel performance requirements, and visitor and subcontractor access control. During the course of these activities, no chemical safety vulnerabilities related to human resource programs were identified.

At the facilities visited, the field verification team concluded that employees are competent to perform their duties and are dedicated, conscientious about safety, and strongly motivated to excel. Further, employees exhibited a high level of knowledge specific to facility mission, priorities, procedures, operations, and job safety. In most cases, personnel assigned to specific programs and projects have several years of relevant experience.

In general, staffing levels at the reviewed facilities are adequate to ensure that work involving chemical hazards is accomplished safely and within the bounds of established procedural constraints. Routine operations requiring use of the "buddy system" (e.g., entry into toxic gas storage areas or placing chlorine cylinders in or out of service) are adequately staffed. In the event that sufficient qualified personnel are not available to perform a given task, the work is placed on hold. None of the facilities visited require employees to work exorbitant amounts of overtime. In fact, overtime rates overall are very low.

Where appropriate, supervisors and employees cooperate to develop individual training plans for each worker and to identify the types of training required to perform specific tasks for which the employee will be responsible. The ES&H Course Catalog contains descriptions of the courses offered by the LANL ES&H Training Group, as well as job-specific training matrices and hazard-specific training guidelines. Included in the catalog are course descriptions and recommended audiences for topics such as asbestos awareness, beryllium health hazards, cryogen safety, hydrogen gas safety, and pressure safety. Not every chemical in use at the reviewed facilities is specifically addressed in the catalog, but training coordinators and operations managers who use the catalog find it beneficial for designing individual training plans. Unfortunately, not all training coordinators know that the catalog is available. Those who learned about its existence during this review requested a copy for future use.

At each facility visited, it was clear that management actively solicits employee involvement to identify and correct workplace hazards, including chemical hazards. When new tasks or projects are undertaken at a facility, workers and management work together to identify potential hazards. This type of cooperation is evident during the planning stage, during equipment installation and checkout (if applicable), during the writing and reviewing of test and operating procedures, and during the actual testing and operation stage of each new task or project.

At LANL, the Whistleblower Policy Office and the Employee Customer Concerns Office (ECCO) receive employee concerns via several means, including the Whistleblower Hotline, the ES&H Hotline, and the ES&H Deficiency Ticket System. Employees can use these mechanisms to report unsafe conditions or practices associated with hazardous chemicals or any other concern. Personnel at ECCO and the Whistleblower Policy Office have developed effective means for dealing with issues brought to their attention, including maintaining confidentiality, channeling concerns to the right managers for resolution, providing feedback to initiators, and, when appropriate, providing input to the LANL lessons-learned program. To the extent possible, employee concerns raised anonymously are processed in the same manner as those for which names are included. The ECCO and the Whistleblower Policy Office are currently active in processing employee concerns. A search of the ECCO data base (which includes the ES&H Hotline, ES&H Deficiency Tickets, the Laboratory Suggestion Program, and the Customer Concerns Program) indicated that in 1992 and 1993 about

13 percent of the issues reported dealt with chemical safety, about 85 percent of which have been tracked to closure. However, not all employees understand that these programs are active and may be used to raise concerns. The reason for this can be traced to the recent LANL reorganization, which shifted many responsibilities and programs from one organization to another. Workers seem to be aware of the programs' existence before the reorganization, but some are uncertain about the current program status. Confusion should diminish as the reorganization matures.

All workers interviewed demonstrated a solid understanding of their "stop work" authority, as promulgated by LANL ES&H training and reinforced by management policies and direction. Workers indicated that they would be comfortable in exercising this authority, as demonstrated by two instances described to the team in which that authority was actually invoked.

At the time of this review, LANL was in the process of testing the recently implemented "360 Degree" employee appraisal system in two of its divisions, including the Dynamic Experimentation Division. This system provides for the traditional review of employee performance, including safety performance, by management. In addition, this system provides a mechanism for workers to participate in the evaluation of management's performance. This approach for appraising employee performance has the potential to increase employee and management accountability for safety at all personnel levels.

At each of the facilities visited during this review, access control was excellent, with particular emphasis placed on controlling access by visitors, subcontractors, and others not normally assigned to the facility. Unauthorized access to potential chemical hazards is effectively prevented either by using locked gates or by posting guards. Where locked gates are used, facility-specific indoctrination training, including chemical safety, must be satisfactorily completed before escorted access is allowed. At the two facilities with posted guards, an access list is checked by a guard before casual visitors and their escorts are allowed to proceed past the guard post. Facility managers at these locations have implemented control measures that require a visitor to complete the required access training before his or her name is added to the access list.

Although some weaknesses exist, the verification team concluded that human resource programs at LANL have the necessary elements in place to ensure the safety of workers and visitors at facilities in which chemical hazards exist. Areas for improvement appeared to be recognized by those who were interviewed, and appropriate steps are being taken to effect the desired improvement.

2.5 Emergency Management Program

Verification activities for the review of the emergency management program functional area included evaluation of the effectiveness of emergency management activities, plans, and program elements as they relate to chemical safety at selected LANL facilities. All facilities examined by the LANL self-evaluation were reviewed, and the scope of the review was expanded in some emergency management areas to include sitewide emergency operations at LANL.

The LANL Emergency Management System comprises several comprehensive emergency management program elements, including emergency plans and emergency plan implementing procedures (EPIPs), coordination between LANL and the community, emergency response training, drills and exercises, emergency supplies and equipment, and emergency support facilities.

The top-level document establishing and describing LANL's overall emergency management program is the *Los Alamos National Laboratory Emergency Management Plan 1993* (LANL EMP) and its associated EPIPs. These documents specifically address emergency response to hazardous chemical accidents. Subordinate to the LANL EMP are specific Building Emergency Plans (BEPs) for facilities in each technical area, relevant standard operating procedures, and pre-fire plans. The Laboratory and Los Alamos County have established an Emergency Management Steering Committee (which includes representatives from offsite agencies) to meet for the purpose of reviewing, analyzing, and discussing emergency planning, preparedness, and response issues. An external Local Emergency Planning Committee (LEPC) is currently being designed and will include a representative from LANL. The LANL Emergency Management System is already well integrated, but the formation of the LEPC will help improve integration and coordination with offsite agencies.

In the event of a hazardous chemical emergency, occupants of the affected facility would evacuate to a predesignated staging area. A sitewide "911" telephone line and several radio channels are available to report occurrences promptly. A "911" call or a radio transmission reporting an incident would go to LANL's Central Alarm Station, where a 24-hour-a-day dispatcher would initiate onsite and offsite emergency response notifications. Several automatic alarms can also generate a chemical emergency response through the Central Alarm Station.

LANL has effectively implemented the use of the Incident Command System in response to all emergencies. The Incident Command System is based on the on-scene management structure protocols of the Federal Emergency Management Agency's National Interagency Incident Management System. The LANL Incident Control Group is part of the LANL Emergency Response Organization. This Incident Control Group is composed of an emergency manager, who assumes the role of the Incident Commander from the initial incident commander at the scene; emergency response personnel with command functions; and specialized teams, as required (e.g., the Laboratory's Hazardous Material [HAZMAT] Response Team, the Crisis Negotiation Team, or the Hazardous Device Team). Local police support, traffic control, and fire and medical response are provided by agreements with Los Alamos County. These personnel respond and function under protocols associated with the Incident Command System. The State of New Mexico and various local communities provide additional support through agreements or memorandums of understanding (MOUs). Federal support is provided through agreements and by request. LANL has 21 such agreements or MOUs in place.

The frequency of formal drills and exercises that include full-scale offsite agency participation and that emphasize hazardous chemical accident scenarios has doubled since 1992. On January 13, 1994, LANL's annual exercise scenario focused on an accident involving a stakebed trailer truck carrying three 1-ton chlorine cylinders. Based on the increased complexity of the scenarios and the incorporation of multiagency participation, the quality of

these drills is good and is improving. A relatively new Hazardous Materials Training Facility in TA-49 is being used to train and conduct practical hands-on HAZMAT drills for both onsite and offsite emergency response organizations (including State organizations). The facility is being supplied with a variety of props for hazardous materials drills, including a wrecked vehicle, leaking process system pipes, ruptured tanks, leaking drums, leaking gas cylinders, mannequins, and a small building used as a drill site. Additional enhancements are planned, including preestablished training areas containing specific types of permanent training props, thereby reducing the staging time for drills. A routine training drill observed at the facility during this review indicated that cooperation, trust, and cross-training between the various specialized teams are facilitated by these activities. The field verification team considers the development and use of this facility to be a commendable practice.

Some facilities reviewed at LANL contain significant quantities of hazardous chemicals. Sufficient types and quantities of HAZMAT response equipment and spill materials are available to mitigate incidental, nonthreatening, easily containable spills. The responses required for a larger spill include evacuating the facility and making appropriate notifications. The HAZMAT Response Team is responsible for containing and/or mitigating HAZMAT situations. The HAZMAT Response Team is part of the Hazardous Materials and Response Group (ESH-10) and, based on its composition, is unique within the DOE complex. The team consists of dedicated, full-time personnel who are trained to the HAZMAT "specialist" level, most of whom have received several hundred hours of HAZMAT training. Professional personnel have either industrial hygiene or health physics backgrounds. The team has been equipped with a state-of-the-art HAZMAT vehicle, plus other vehicles and trailers containing personnel protective equipment, supplies, and the tools needed to mitigate HAZMAT situations. On request, the team provides HAZMAT response to LANL, surrounding communities, and the State of New Mexico. In addition, ESH-10 coordinates safety and health support for the offsite deployment of the Accident Response Group, the Nuclear Emergency Search Team, and the Radiological Assistance Plan.

LANL maintains an Emergency Operations Center (EOC) in TA-59 and an alternate EOC in TA-49 to support the Laboratory's emergency response efforts. After touring these facilities, the field verification team concluded that the LANL EOC is in excellent condition and contains mostly state-of-the-art equipment. A computer software model, Meteorological Information and Dose Assessment System (MIDAS), was recently installed to calculate and display hazardous material plume dispersions. As part of the Laboratory's search for better modeling accuracy, and at significant cost and effort, MIDAS has been extensively modified to incorporate site-specific meteorological factors to account for the effects of the complicated local terrain on dispersion calculations performed at the LANL site. The field verification team considers these modifications to be a commendable practice. The Laboratory has the capability to perform hazardous chemical plume dispersion calculations by various approved computer models both in the EOC and in the field.

LANL has developed, maintains, and continues to improve its Emergency Management System. The system is fully capable of responding to and mitigating the consequences resulting from chemical emergencies. No explicit chemical vulnerability issues related to the LANL Emergency Management System were identified.

3.0 CATEGORIZATION AND PRIORITIZATION OF VULNERABILITIES

3.1 Criteria

A vulnerability is defined as a weakness or potential weakness involving hazardous chemicals that could result in a threat to the environment, the public, or worker health and safety. Vulnerabilities can be characterized by physical or programmatic conditions associated with uncertainties, acknowledged deficiencies, and/or unacknowledged deficiencies in the area of chemical safety. Conditions required to create the vulnerability should either currently exist or be reasonably expected to exist in the future based on degradation of systems and chemicals or through expected actions (e.g., D&D of facility).

A vulnerability will be determined to exist if current or expected future conditions or weaknesses could result in either of the following:

- The death of or serious physical harm[1] to a worker or a member of the public or continuous exposure of a worker or member of the public to levels of hazardous chemicals above hazardous limits; or

- Environmental impacts resulting from the release of hazardous chemicals above established limits.

The prioritization of chemical safety vulnerabilities is based on professional judgment of team members concerning the immediacy of the potential consequences posed by each vulnerability and on the potential severity of those consequences. The first step in the prioritization process was to group vulnerabilities according to the timeframe in which they are expected to produce consequences. The following categories are defined for the timeframe within which the consequences are expected to occur:

- Immediate – Any chemical safety vulnerability that could result in immediate consequences.

- Short-Term – Any chemical safety vulnerability at a facility in which there is a significant chance of a consequence occurring within a 3-year timeframe as a result of chemical degradation, change in mission for the facility, degradation of the containment systems, change in personnel at the facility, or other factors affecting the facility.

- Medium-Term – Any chemical safety vulnerability at a facility in which there is a significant chance of a consequence occurring within a 3–10-year timeframe as a result of chemical degradation, change in mission for the facility, degradation of the containment systems, change in personnel at the facility, or other factors affecting the facility.

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[1] Serious physical harm is defined as impairment of the body, leaving part of the body functionally useless or substantially reducing efficiency on or off the job.

- Long-Term – Any chemical safety vulnerability at a facility in which there is a significant chance of a consequence occurring within a timeframe of more than 10 years as a result of chemical degradation, change in mission for the facility, degradation of the containment systems, change in personnel at the facility, or other factors affecting the facility.

Vulnerabilities within each category should be further prioritized to specify "high," "medium," or "low" priority. Consequences of high priority would cause death or irreversible injury to workers or the public, or would cause environmental damage that would be irreversible or very costly to remediate. Low-priority consequences would consist of reversible injuries, illnesses, or environmental damage.

3.2 Chemical Safety Vulnerabilities at Los Alamos National Laboratory

The chemical safety vulnerabilities summarized in this section were derived from observations made during the field verification process. Three vulnerabilities were identified at Los Alamos. These vulnerabilities have been prioritized in accordance with guidance provided in Section 3.1, which was derived from Attachment 7 of the "Project Plan for the Chemical Safety Vulnerability Review," dated March 14, 1994. (Completed vulnerability forms are provided in Attachment 2 of this appendix.)

CSVR-LANL-CH-01: Significant accumulations of hazardous chemicals and wastes are being stored for prolonged periods, some under unsatisfactory conditions.

A legacy of hazardous chemicals and wastes, resulting from decades of operations, exists at LANL. Many of these materials are being collected, characterized, stored, and prepared for disposal. Some materials are stored temporarily under less-than-satisfactory conditions that could lead to personnel hazards or environmental releases caused by leakage from corroded tanks, drums, or gas cylinders. For example, the deterioration of drums and cylinders exposed to the elements could result in the release of hazardous chemicals and radioactivity. These conditions and circumstances represent a medium-priority vulnerability with a potential for short-term consequences.

CSVR-LANL-FM-02: The lack of funding could affect the safe cleanup or transition of aging and/or inactive facilities.

Many aging and/or inactive facilities at LANL are candidates for transition (e.g., to D&D). Funding for these facilities is uncertain or not available, and workload changes are contemplated. These circumstances result in an unacceptable level of maintenance and surveillance at facilities in which residual hazardous chemicals may pose a threat to workers, the public, or the environment. These conditions and circumstances represent a medium-priority vulnerability with a potential for short-term consequences.

CSVR-LANL-OMS-03: The absence of a consistent approach to chemical safety at Los Alamos National Laboratory can result in unanticipated chemical risks.

The absence of a consistent and integrated approach to chemical safety at LANL has resulted in improper chemical safety practices. A Laboratory-wide chemical safety policy does not exist, and supporting programs have not been developed in a timely manner. The absence of

a consistent and integrated chemical safety program could result in a variety of undesirable consequences: chemical inventories may be inaccurate; waste in facilities and process equipment may not be properly characterized; unwanted chemical reactions, including explosions, could occur; workers, the public, and the environment could be exposed to hazardous substances; fires could be started; and unnecessary hazardous or mixed waste could be generated. These conditions and circumstances represent a medium-priority vulnerability with a potential for short-term consequences.

ATTACHMENT 1

TEAM COMPOSITION

Area of Responsibility	Name/Organization
Team Leader	Leonard M. Lojek Office of Safety and Quality Assurance U.S. Department of Energy
Management/Operations	Bernard R. Kokenge BRK Associates, Inc.
Management/Training	Nels C. Jensen EG&G Idaho, Inc.
Chemical Process Safety	Harold J. Groh HJG, Inc.
Industrial Hygiene	Ronald E. Alexander Environmental Management Associates
Environmental Protection	Julie M. Magness EG&G Mound Applied Technologies
Maintenance	David M. Johnson Program Management, Inc.
Emergency Management	Robert D. Mogle Battelle, Pacific Northwest Laboratory
Site Liaisons	John T. Ryan Los Alamos Area Office U.S. Department of Energy
	Jeffrey E. Schinkel Los Alamos National Laboratory
Senior Coordinator	Stephanie G. West Fernald Environmental Management Company of Ohio
Coordinators-In-Training	Lisa L. Alexander Program Management, Inc.
	Florence G. Parkhill Program Management, Inc.
Technical Editor	Darla Treat Courtney Environmental Management Associates

ATTACHMENT 2

CHEMICAL SAFETY VULNERABILITY REVIEW
VULNERABILITY FORM DATE: May 25, 1994

Site/Facility: Los Alamos National Laboratory

Vulnerability Number: CSVR-LANL-CH-01

Functional Area(s): Identification of Chemical Holdings

1. Brief Description of Vulnerability.

   Significant accumulations of hazardous chemicals and wastes are being stored for prolonged periods, some under unsatisfactory conditions.

2. Summary of Vulnerability.

   A legacy of hazardous chemicals and wastes, resulting from decades of operations, exists at Los Alamos National Laboratory (LANL). Many of these materials are being collected, characterized, stored, and prepared for disposal. Some materials are stored temporarily under less-than-satisfactory conditions that could lead to personnel hazards or environmental releases caused by leakage from corroded tanks, drums, or gas cylinders.

3. Basis.

   a. Requirements:
      - 29 CFR 1910.119, "Process Safety Management of Highly Hazardous Chemicals," describes process safety management programs for preventing or minimizing the consequences of releases of toxic, reactive, flammable, or explosive chemicals.
      - 40 CFR 68, "Risk Management Programs for Chemical Accidental Release Prevention," requires hazards assessments and risk management plans for accidental chemical release prevention.
      - DOE 5480.10, "Contractor Industrial Hygiene Program," requires contractors to identify and evaluate chemical hazards in the workplace and to implement control measures to prevent or minimize exposure to these hazards.
      - 40 CFR 260 through 40 CFR 270, "Federal Hazardous Waste Management Regulations," describe generation, treatment, storage, and disposal of hazardous wastes.
      - Federal Facility Compliance Agreement (FFCA), dated June 1993, outlines schedules for characterization, treatment, and disposal of mixed wastes at LANL.

   b. Chemicals Involved:
      - Flammable and toxic gases
      - Mixed hazardous waste
      - Radioactive liquid wastes

   c. Relevant Self-Evaluation Data: The self-evaluation lists drums of mixed wastes and gas cylinder wastes, recognizes the potential for deterioration and leakage, and describes a plan to erect a shelter over the mixed-waste drums.

Site/Facility: Los Alamos National Laboratory

Vulnerability Number: CSVR-LANL-CH-01

Functional Area(s): Identification of Chemical Holdings

3. Basis. (Continued)

d. Contributing Causes:
- Aging drums and cylinders are susceptible to leakage.
- The decision-making process for negotiating and implementing disposal options is protracted.
- Technologies to treat and dispose of wastes are limited.

e. Potential Consequences: The deterioration of drums and cylinders exposed to the elements could result in the release of hazardous chemicals and radioactivity, causing worker exposures and releases to the environment. These conditions and circumstances represent a medium-priority vulnerability with a potential for short-term consequences.

4. Supporting Observations.

The verification team did not conduct a comprehensive review of legacy wastes at LANL. The following examples were observed at the facilities included in the self-evaluation report.

- Several thousand gas cylinders containing a wide variety of flammable and toxic gases were collected from LANL facilities during 1990–91 and stored as waste at the Waste Storage Facilities (TA-54, Area L). About 500 cylinders remain at the site, about 30 of which are uncharacterized. The remaining uncharacterized cylinders will be sampled and analyzed by an onsite contractor by June 1994. The cylinders are stored in metal racks in Area L under a structure consisting of an aluminum frame and laminated polyester fabric; the structure is equipped with lightning protection. The uncharacterized cylinders are stored separately from those that have been characterized. Many cylinders are old and corroded. Gases contained in the waste cylinders include flammables (e.g., propylene, isobutane, hydrogen, and methane), corrosive gases (e.g., hydrogen fluoride, hydrogen chloride, nitric oxide, and sulfur dioxide), and toxic gases (e.g., arsine, phosgene, cyanogen, and phosphine). By the end of 1994, all but about 100 cylinders will have been transferred to offsite treatment facilities. The remaining cylinders are radiologically contaminated, are not in Department of Transportation-approved containers, or cannot be processed in offsite treatment facilities. Disposition plans for the remaining cylinders are being developed under the FFCA between the Los Alamos Area Office and Environmental Protection Agency (EPA), Region 6. Disposal will probably require new treatment units at LANL and may take several years to complete.

Site/Facility: Los Alamos National Laboratory

Vulnerability Number: CSVR-LANL-CH-01

Functional Area(s): Identification of Chemical Holdings

4. Supporting Observations. (Continued)

- About 4,000 drums of waste have been accumulated in above-ground storage facilities at TA-54.
  - At Area L, about 1,000 drums of mixed waste and 1,000 drums of nonregulated, radioactive wastes are stored on wooden pallets, unprotected from the weather and stacked two or three drums high. Thirty of the 2,000 drums remain uncharacterized, but these will be sampled and analyzed as part of a continuing program. The drums in Area L contain liquids and labpack wastes in a variety of hazard classes, including acids, oxidizers, flammables, and caustics. The metal drums provide secondary containment (overpacks). Corrosion of the drums could cause leaks. The storage area is inspected daily. Construction of a containment structure is scheduled to begin in June 1994, and the drums will be transferred to secondary containment pallets. Requirements for the containment structure and the pallets were negotiated in the FFCA, and the Resource Conservation and Recovery Act Part B permit has been modified to allow construction of the storage facility. The ultimate disposal plan for these wastes is being developed under the FFCA.
  - At Area G, about 2,000 drums of solid mixed waste are stored in an enclosed structure for protection from the weather. These drums contain a variety of hazardous materials, including uranium, mercury, cadmium, and barium-contaminated waste. About 1,000 of the drums contain de-watered sludge from the radioactive liquid waste treatment plant. The ultimate disposal plan for these wastes is being developed under the FFCA.
- Four tanks in TA-3, Bldg. 154, contain about 3,100 gallons of radioactive waste from the hot cells in Wing 9 of the Chemistry and Metallurgy Research Facility (CMR) (TA-3, Bldg. 29). Building personnel indicated that this waste has been in Building 154 about 1½ years without full characterization.
- An abandoned laboratory in the CMR facility contains hazardous waste in several drums that have been in storage in a satellite accumulation area for about 2 years without being completely characterized. Because the waste originated in a controlled radiation area, it should be regarded as suspect mixed waste. Some sampling and analysis have been performed, but to be official, the results must be analyzed by a laboratory approved by the EPA. The laboratory operated by Chemical Science and Technology Division, Environmental Chemistry Group (CST-9), is the approved laboratory on site, but backlogs for samples are as long as 6 months.

CHEMICAL SAFETY VULNERABILITY REVIEW
VULNERABILITY FORM DATE: May 25, 1994

Site/Facility: Los Alamos National Laboratory

Vulnerability Number: CSVR-LANL-FM-02

Functional Area(s): Facility Physical Condition

1. Brief Description of Vulnerability.

   The lack of funding could affect the safe cleanup or transition of aging and/or inactive facilities.

2. Summary of Vulnerability.

   Many aging and/or inactive facilities at Los Alamos National Laboratory (LANL) are candidates for transition (e.g., to decontamination and decommissioning, or D&D). Funding for these facilities is uncertain or not available, and workload changes are contemplated. These circumstances result in an unacceptable level of maintenance and surveillance at facilities in which residual hazardous chemicals may pose a threat to workers, the public, or the environment.

3. Basis.

   a. Requirements:
      - DOE 4330.4B, "Maintenance Management Program," requires that maintenance activities be implemented to ensure safe working conditions.
      - "DOE Office of Environmental Management (EM-40) D&D Guidance Document" provides D&D process guidance.

   b. Chemicals Involved:
      - Hazardous wastes
      - Residual explosive materials
      - Flammable solvents
      - Radioactive waste

   c. Relevant Self-Evaluation Data: The self-evaluation for the High Pressure Tritium Laboratory (HPTL) (TA-33, Bldg. 86) recognized that a complete knowledge of the facility's chemical hazards is lacking and that residual explosives materials are potentially located in some systems at the Explosives Development Processing Facility (TA-16, Bldg. 340).

   d. Contributing Causes:
      - Lack of funding for maintenance and surveillance activities at inactive facilities in transition (e.g., HPTL).
      - Lack of funding for maintenance activities and uncertainty about future funding for the Explosives Development Processing Facility.
      - Increased workload without committed funding for the Explosives Development Processing Facility.
      - Poor condition of some process support system equipment at the Explosives Development Processing Facility.
      - Aging of such facilities as HPTL and the Explosives Development Processing Facility.

   e. Potential Consequences: Residual hazardous substances at LANL could pose a threat to workers, the public, or the environment in facilities that are either inactive or are not well maintained. These conditions and circumstances represent a medium-priority vulnerability with a potential for short-term consequences.

Site/Facility: Los Alamos National Laboratory

Vulnerability Number: CSVR-LANL-FM-02

Functional Area(s): Facility Physical Condition

4. Supporting Observations.

- The Explosives Development Processing Facility is an aging facility in need of increased maintenance attention. The general condition of the facility and support systems range from fair to poor. The roof is cracked and shows evidence of leaks, and process instrumentation lacks effective maintenance. Further deterioration of this equipment is expected because the need for this equipment has not been projected. Facility management indicated that there has been a significant reduction in programmatic operations and maintenance funds over the past 4 years, declining from about $2 million in fiscal year (FY) 90 to only $350,000 this year.

- DOE plans to transfer its explosive powder operations from another DOE site to the Explosives Development Processing Facility. To accomplish this added workload, the Dynamic Experimentation Division (DX-16) has requested funding to upgrade equipment and to address many of the problems cited above. However, DOE has not yet committed funds to support this request.

- Tritium samples, molecular sieves, and tritiated water are currently being removed from HPTL using existing reprogrammed Laboratory funds provided by the Office of Defense Programs (DP). The removal of most of these accountable tritium materials is scheduled to be completed by the end of FY 94. However, the remaining tritium residuals and other chemical residues will not be removed as part of this effort.

- Currently, there are no committed funds for FY 95 to complete the characterization of HPTL and to remove residuals. The only potential source of funding appears to be existing DP Laboratory funds, which have not yet been identified. Without sufficient funds to prepare this aging facility for a safe surveillance and maintenance condition, hazards resulting from residuals will continue to pose a threat to workers and the environment.

- LANL has identified about 100 facilities on its "Environmental Restoration and Waste Management Facility Inventory and Assessment Database." Of these, about 60 facilities are classified as surplus and are radiologically and/or chemically contaminated. Although a preliminary characterization of most of these 60 facilities is now under way and should be completed by the end of FY 94, there is no commitment by either DP or the Office of Environmental Management to fund the cleanup and deactivation of these facilities. The purpose of the deactivation process is to prepare these facilities for a safe surveillance and maintenance condition while they await ultimate D&D.

- The Explosives Development Processing Facility and the HPTL, in addition to similar facilities at other DOE sites, are in deteriorating condition, indicating that the Department has not effectively addressed the issue of the overall life cycle of its facilities. Having completed their missions, such facilities are not adequately funded for deactivation and a safe surveillance and maintenance condition while awaiting D&D.

CHEMICAL SAFETY VULNERABILITY REVIEW
VULNERABILITY FORM

DATE: May 25, 1994

Site/Facility: Los Alamos National Laboratory

Vulnerability Number: CSVR-LANL-OMS-03

Functional Area(s): Operational Control and Management Systems

1. Brief Description of Vulnerability.

   The absence of a consistent approach to chemical safety at Los Alamos National Laboratory can result in unanticipated chemical risks.

2. Summary of Vulnerability.

   The absence of a consistent and integrated approach to chemical safety at Los Alamos National Laboratory (LANL) has resulted in improper chemical safety practices. A Laboratory-wide chemical safety policy does not exist, and supporting programs have not been developed in a timely manner.

3. Basis.

   a. Requirements:
      - 29 CFR 1910.119, "Process Safety Management of Highly Hazardous Chemicals," describes requirements for chemical processes.
      - DOE 5480.10, "Contractor Industrial Hygiene Program," requires routine chemical monitoring and a health hazards inventory.
      - The National Fire Protection Association 40 series of standards describes requirements for storage of flammables.

   b. Chemicals Involved:
      - Acids
      - Caustics
      - Oxidizers
      - Reducing agents
      - Organics
      - Radioactive materials
      - Fissile materials
      - Petroleum products

   c. Relevant Self-Evaluation Data: Chemical inventories exist for most LANL facilities.

   d. Contributing Causes:
      - Inappropriate management priorities
      - Insufficient resources
      - Inadequate guidance on chemical safety practices
      - Lack of comprehensive chemical hazards analyses
      - Ineffective communications among Laboratory divisions and groups

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e. Potential Consequences: The absence of a consistent and integrated chemical safety program could result in a variety of undesirable consequences: chemical inventories may be inaccurate; waste in facilities and process equipment may not be properly characterized; unwanted chemical reactions, including explosions, could occur; workers, the public, and the environment could be exposed to hazardous substances; fires could be started; and unnecessary hazardous or mixed waste could be generated. These conditions and circumstances represent a medium-priority vulnerability with a potential for short-term consequences.

4. Supporting Observations.

- Several hundred gallons of acids and caustics are stored alongside drums containing radioactive and fissile materials in a small storage area in the Chemistry and Metallurgy Research Facility (CMR)(TA-3, Bldg. 29). Secondary containment has not been provided to prevent the commingling of incompatible chemicals or damage to radioactive and fissile materials drums in the event of an unplanned chemical release. If a chemical release should occur, unplanned chemical reactions, explosions, exposure to the public or the environment, or personnel exposures to toxic materials could result.

- Although administrative requirements (ARs) include storage requirements for wastes, flammable liquids, and laboratory-scale chemicals, LANL has not established criteria addressing concerns such as chemical incompatibilities, flammable-vapor monitoring, or the concurrent storage of chemicals with radioactive or fissile materials. Storage criteria for other chemicals are not well defined or understood.

- LANL management has not addressed chemical safety-related issues in a timely manner, and various aspects of a comprehensive chemical safety program do not exist. For example, Occupational Safety and Health Administration (OSHA) regulations required LANL to begin implementing a laboratory safety program in January 1990, but LANL did not have a chemical hygiene plan until June 1993. LANL has not prepared a lead management program in response to 29 CFR 1926.62. In addition, LANL has not prepared a formal underground storage tank program or a chemical process safety management plan.

- A questionnaire (described in AR 1-10, "Environment Safety, and Health Questionnaire") intended for use in review of proposed research projects, process changes, and facility modifications has not been used consistently and is sometimes not completed in a timely manner.

Site/Facility: Los Alamos National Laboratory

Vulnerability Number: CSVR-LANL-OMS-03

Functional Area(s): Operational Control and Management Systems

4. Supporting Observations. (Continued)

- LANL allows individual organizations a wide latitude in the implementation of Laboratory policies and standards. Some personnel see LANL policies and standards as requirements, whereas others regard them as guidance only. For example, one scientist (who was aware of a LANL requirement to the contrary) justified storing laboratory quantities of acids and caustics in the same location because the chemicals were dilute.

- Some chemical emergency eyewash stations and drench hoses use nonpotable water that may contain chemical and bacteriological contaminants. In the event of a chemical accident, use of this water could contribute to eye injury or damage.

- Health hazard assessments have not been performed for many LANL facilities in which chemical uses and processes are located. Funding is not currently approved to perform a comprehensive health hazards assessment.

- Chemical waste in tanks at TA-3, Bldg. 154, has not been fully characterized. Facility personnel indicated this waste has been in the tanks for about 1½ years. The waste, which originated in the hot-cell wing of the CMR, is radioactive.

ATTACHMENT 3

SELECTED ACRONYMS

CFR	Code of Federal Regulations
D&D	Decontamination and Decommissioning
DOE	U.S. Department of Energy
EH	DOE Office of Environment, Safety and Health
EPA	U.S. Environmental Protection Agency
ES&H	Environment, Safety, and Health
FY	Fiscal Year
JCI	Johnson Controls World Services, Inc.
LANL	Los Alamos National Laboratory
OSHA	Occupational Safety and Health Administration
RCRA	Resource Conservation and Recovery Act
SARA	Superfund Amendments and Reauthorization Act
TA	Technical Area